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ICE CONDITIONS IN DANISH WATERS, 690-1860.<sup>1</sup>

We have very striking reports from the times of the fourteenth and fifteenth centuries concerning the freezing over of the Baltic (Ostsee) and even of the "Skagerrak" or the North Sea (German Ocean). These reports have been so positive that many have believed them to be undeniable evidence of a change in natural conditions since those times; that they indicate either a warming of the climate or, as Pettersson has suggested, an increase in the depth of the less salty superficial stratum of the Baltic waters with a resultant intensification in the vertical circulation, so that the winter cooling is at present distributed throughout a greater water mass than formerly.

The author of this first attempt at a comprehensive study of the ice conditions in Danish waters during historic times reaches another conclusion, however. After ten years of searching—at first it seemed like searching for a needle in a haystack—the author seems to have exhausted all existing material. His general result is that the ice conditions have not altered demonstrably during historic times. Not until recent years has there been any essential change, and the recent failures to form firm ice bridges are due to the disturbing steamship traffic.

The occasions when, in the years 1635 and 1709, persons walked across the ice bridge from the island of Bornholm to Sweden or Rügen were reported as very remarkable events; the conditions recurred in 1838 and had it not

been for the steamboats, would have returned in 1893. The reported earlier "lively travel" on the ice may be compared with similar reports in recent years, e. g.—the report by Ritzau's Bureau on March 18, 1909, concerning traffic across the "Kleinen Belt" (strait between Schleswig-Holstein and the Island of Fünen), upon investigation turned out to have been based upon the fact that two men dared to walk across and a number of children played near the shore. One is all the more justified in assuming similar exaggerations in earlier times also, since among the reports are some demonstrably false ones. General statements such as "the Baltic was frozen over," "the Black Sea was frozen over," may with certainty be interpreted as applying to individual bays only.

In part, however, this unreliability of the records is due to special causes. Thus the names of the bodies of water about Denmark have suffered changes, in part. As late as the 18th century the waters off Copenhagen were not called The Sound [Sund], but the Baltic (Ostsee), the Kattegat was called the Skagerrak, and sometimes the Kattegat was even called the North Sea. Very often, also, a copyist has interchanged the figures when writing a year; for example, different sources of information have written 1292, 1294, 1296, and 1269, when the correct year was 1296; similarly, 1320, 1323, and 1333 should all read 1323. That New Years falls in the wintertime also often causes uncertainty regarding the year number.

The principal source of information for the years since 1750 has been the Berlingske Tidende. Between 1750 and 1799 The Sound [Sund] was full of ice in 29 years, and in 10 of those years it was possible to cross the [Sund] on the ice. From 1800 to 1849 the [Sund] was full of ice in 19 years, and in 9 years it was crossable. After 1850 the increasing steamer traffic made such comparisons impossible; nevertheless even to-day traffic on Danish waters is interrupted by ice in one year out of three. Also ice-conditions reports have been instituted seven times by the Danish Meteorological Institute. At the beginning of winter heavy frosts have no effect in forming ice, because at that season the water is still too warm; ice forms only in long or late winters. In hard winters, to-day as in earlier times, the waters begin to freeze about the first of February and remain frozen until the middle of March. As early as the 16th century navigation used to open in March, the buoys were set out about March 1 and the lights re-lit.

There has been no noticeable change in all these features since certainly as early as the 15th century. Conditions of these waters since 1860 will be discussed in a later study.

<sup>1</sup> Speerschnelder, C. J. H. Om isforholdene i Danske farvande Aarene 690-1860. Copenhagen, 1915. 141 p. Plate. (Dans. meteorol. Instit., Public. Mitt. 2.) Translated from abstract by V. Köppen in *Met. Ztschr.* apr. 1915, 32: 188-9.)